A1250-1
2/10/87

FINAL PROGRAM
ACS spring meeting in Denver
Page 31

FEBRUARY 9, 1987
CHEMICAL & ENGINEERING

NEWS

CDTL/79C697 Y K ARCO/CCSL
CONGRESSIONAL INFO SERVICE/SRI
4226 EAST WEST HWY SUITE 800
SRI ACQUISITIONS
BETHESDA MD 20814

Petrochemicals

Capacity limitations hit ethylene
Page 9

CHEMICAL & ENGINEERING
NEWS
FEBRUARY 9, 1987

Volume 65, Number 6
CENEAR 65 (6) 1–120
ISSN 0009-2347

News of the Week

■ **Experts in chemical hazard prevention examine the chemical industry's response to the regulatory revolution in the world of chemical safety.** **Page 4**

■ **Reinforced plastics and composites will do even better in 1987 than in 1986, as a result of the continuing emergence of products and new applications for composites.** **Page 5**

■ **First rotary slagging kiln dedicated solely to incineration of PCBs has begun commercial operation in Kansas.** **Page 5**

■ **Chemical trade surplus last year totaled $7.77 billion, a rise of 8% from 1985 and a reversal of a five-year downward trend.** **Page 6**

International Business

U.K. chemical industry's prospects look bright for 1987, as capacity use and domestic sales increase. **Page 14**

Canadian plastics processors, coming off a good year in 1986, expect even higher sales and profits in 1987. **Page 17**

Government

In 1987, House Science, Space & Technology Committee will debate a broad range of science policy issues. **Page 19**

EPA updates hazardous waste sites list, adding 64 sites and removing one, which brings the total on its national priorities list to 951. **Page 21**

Science

A new method to make cyclic disulfides routinely has been developed by a team of chemists at the University of Montreal. **Page 23**

Technology

Neutron detector based on polyacetylene, a conductive organic polymer, offers advantages over previous detection methods. **Page 24**

New attrition-resistant catalyst makes use of transport-bed technology possible in the production of maleic anhydride. **Page 24**

Final Program

Program for 193rd ACS National Meeting in Denver includes listing of all technical papers and exposition exhibitors, registration form. **Page 31**

Cover: Union Carbide's ethylene derivatives plant in Texas City, Tex.

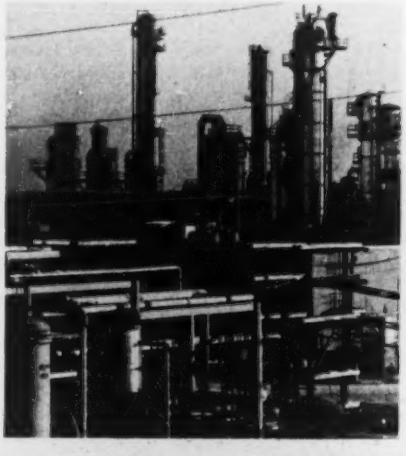
Letters 2

Concentrates

Business 7
Government 18
Science/Technology 22

The Departments

ACS News 25
Meetings 107
Newscripts 120



Business

Basic petrochemicals production will continue to climb in 1987; record volumes are predicted for ethylene and propylene with prices strengthening and profits improving. **Page 9**

Molten glass flowing over the refractory inner surface of the kiln promotes high temperatures and good heat transfer. The glass encapsulates combustion residue in a nonleachable solid that can be disposed of in approved landfills. Combustion gases pass to an afterburner. There, the company says, efficiency of destruction and removal exceeds Environmental Protection Agency standards.

PCBs were used as dielectric fluids in transformers, capacitors, and circuit breakers until the early 1970s. At that time, their use ceased, owing to evidence that PCBs cause human skin and liver disease, and cancer and birth defects in lab animals.

EPA estimates that about 150,000 transformers are still in use in the U.S., containing a total of 300 million lb of PCBs. In addition, PCBs contaminate dielectric fluids of a few million capacitors and other transformers, resulting from residues left behind as fluids have been replaced over the years.

Pyrochem spokesmen say that the speed and efficiency of its incineration process enables them to issue certificates of destruction to clients promptly at the completion of each job. Also, the company is equipped to keep careful records of the receipt and destruction of PCBs and contaminated oils, soil, clothing, and debris.

Other Westinghouse PCB services include risk analysis at customer plants and analyses of fluids and solids. The firm also has a process to remove old fluid from a transformer and circulate a proprietary dielectric fluid through the transformer for six to nine months while it remains in full operation. As the dielectric circulates outside the transformer, another unit removes PCBs from it before return. □

Chemical trade surplus rebounds

In a year when the U.S. trade deficit hit record levels in spite of a steadily eroding dollar, the chemical industry saw the decline of its trade surplus halted and a recovery begin.

Chemicals, one of only a handful of U.S. industries to continually show more exports than imports, had been in a decline since its trade balance hit a peak in 1980, according to figures from the Commerce Department.

Between 1980 and 1985, the chemical trade surplus declined almost 41% to about $7.23 billion. Exports of chemicals and products during that time rose just 5%, or an average annual rate of just 1%, to a value of about $21.8 billion. Meanwhile, imports increased 70% to about $14.5 billion, an average annual growth rate of about 11%. Thus, the trade surplus for chemicals fell at an average yearly rate of nearly 10%.

Last year brought a turnaround, however. Although the trade surplus still has a long way to go to get back to its 1980 peak, it has recovered somewhat. The surplus in 1986 rose almost 8% from 1985 to $7.77 billion. Chemical exports rose 5% to a value of $22.8 billion. Imports also increased, but at just 3%, to total $15.0 billion.

During the first part of 1986, the outlook for chemical trade still looked bleak. In the first quarter, the surplus was down 19% from first-quarter 1985 to $1.70 billion. Exports of chemicals and allied products during those three months were down 2% to about $5.60 billion. And chemical imports were still increasing rapidly, rising 8% to $3.89 billion.

The situation turned around in the second quarter. Chemical exports rose 3% from 1985's second quarter to $5.64 billion, and imports actually fell 5.0% to $3.74 billion. In that quarter, the surplus rose 27% from second-quarter 1985 to almost $1.90 billion. That was enough to bring the surplus in the year's first half even with the first six months of 1985 at $3.60 billion, on a 1% increase in exports to $11.2 billion and a 1% increase in imports to $7.63 billion.

In the third quarter, the surplus showed some retrenchment, with exports rising 5% from the year-earlier quarter to $5.79 billion, but imports climbing 10% to $3.70 billion. Thus, the surplus fell 1.7% from the previous year's third quarter to about $2.09 billion.

It was the fourth quarter's strong performance that really turned the year's chemical trade surplus upward. Exports totaled $5.74 billion, a 12% gain from 1985's fourth quarter, and imports increased just 1% to $3.67 billion. Thus, the surplus increased almost 39% to $2.07 billion.

December figures, released late last month, show the best results of the year. Chemical exports in December amounted to $1.91 billion, up less than 1% from the previous month but 16% more than in December 1985. Imports, meantime, totaled $1.21 billion, down 11% from November but still up almost 4% from a year earlier. The December surplus totaled almost $700 million, a month-to-month gain of 29% and an annual increase of 47%.

December's was the best year-to-year increase in the surplus for any month in 1986 and it completed a four-month string of healthy double-digit annual gains. In September the trade surplus jumped 33% from a year earlier, in October 31%, and in November 41%. □

Chemical trade surplus ended slide last year

$ Billions	1986	1985	1984	1983	1982	1981	1980
Exports	$22.77	$21.76	$22.31	$19.79	$19.89	$21.19	$20.74
% change from previous year	4.6%	−2.5%	12.7%	−0.5%	−6.1%	2.2%	19.8%
Imports	15.00	14.53	13.69	10.80	9.49	9.32	8.54
% change from previous year	3.2%	6.2%	26.7%	13.8%	1.8%	9.1%	14.1%
Surplus	7.77	7.23	8.62	8.98	10.40	11.87	12.20
% change from previous year	7.5%	−16.2%	−4.0%	−13.6%	−12.4%	−2.7%	24.2%

Production of Basic Petrochemicals Will Continue Upward in 1987

Record volumes will be set for ethylene and propylene as prices strengthen following mid-1986 decline and improve producers' profitability

Bruce F. Greek, C&EN Houston

Good times have returned for producers and sellers of basic petrochemicals—some of the best times in nearly a decade.

Demand for ethylene and propylene for chemical and polymer uses will hit new highs again in 1987 as prices are strengthening following the precipitous decline of mid-1986. Benzene output also may grow more in 1987 than in the past four years. Other basic petrochemicals and many of their derivatives are being produced in record volumes and are returning a better profit than producers have had so far in the 1980s.

The outlook beyond 1987, even with capacity to make some of these petrochemicals now operating at effective limits, remains conservative, with no major round of plant construction.

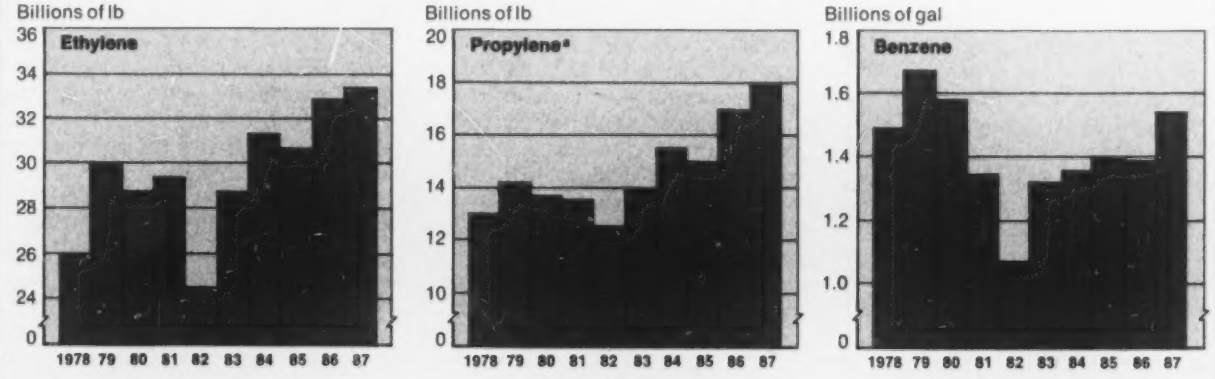
Selling prices of most basic petrochemicals increased late in 1986, after following the decline in crude oil prices early in 1986. Further price increases have been made already in 1987, with most industry observers expecting more to occur, as long as crude oil prices hold. Despite combined increases, however, prices haven't risen enough to allow returns on investment to reach levels at which more capacity can be built, even with lower overall construction costs than five years ago. As a result, capacity increases for basic petrochemicals will be small throughout the rest of this decade.

Key Chemicals

Aside from the low return on investment, many industry planners question whether the current increases in end-use demand can be sustained and whether demands will be filled as in the past. Demand growth rates last year for many first- and second-line derivatives were double or more the average growth rates of the previous five years. Such current economic factors as low interest rates and strong consumer spending led to the high growth. Should the economy slow, then the growth in demand for products made of the basic petrochemicals could reverse, as sales decline and inventories build. Most forecasts for growth in basic petrochemicals in 1987 are about half their 1986 rate, because of the expected slower demand growth.

A significant part of basic petrochemical production is exported as derivatives. These exports have a growing competition from new production in other countries in spite of a weaker dollar. If exports of the derivatives, and products made from them, decline, then the U.S. market will have to absorb the loss in exports to sustain production growth. The loss in exports, in effect, would reduce the need to expand capacity. If exports then are replaced by imports produced by competing for-

Output of ethylene and propylene rises faster than that of benzene



a Used for chemicals and polymers. **Sources:** U.S. International Trade Commission, C&EN estimates

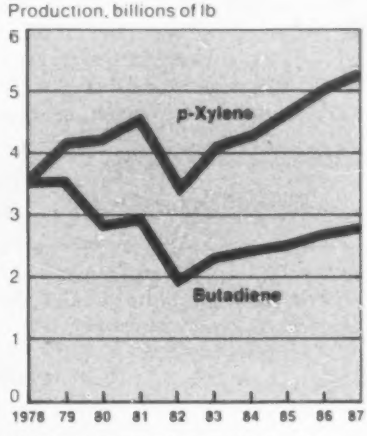
Smaller-volume petrochemicals, butadiene and *p*-xylene, continue to grow

Two important smaller-volume basic petrochemicals—butadiene and *p*-xylene—continue to grow steadily. Butadiene output this year will approach 3 billion lb, and *p*-xylene output will top 5.25 billion lb. These two petrochemicals as well as others such as *o*-xylene, toluene, and the butenes have less diverse derivative patterns than do ethylene, propylene, and benzene. Consequently, they are subject to the fluctuations of a single industry.

Butadiene goes largely to make elastomers, with tires dominating the end uses. Among other uses, high-performance plastics are fast growing. Because of improvements in the elastomers themselves, as well as in carbon black and other materials used as reinforcements, and in tire design and construction, tire life has increased greatly. And if the effect of the shift toward lighter cars is included, tire life for most motorists has more than doubled over the past 10 years.

Because tire manufacturing has slowed, butadiene output has dropped drastically since 1979. Imports have increased and at times accounted for a quarter of U.S. demand. This year, imports will drop to about 10% of U.S. consumption. Most butadiene now is a coproduct of steam cracking to make ethylene.

Butadiene prices fell during 1986 more than other basic petrochemical prices, caused by further slowing of demand and a surge of imports. Prices in 1986 reached their nadir in October, at about 9 cents per lb, after rising as high as 29 cents per lb in January. But prices have recovered because of a rapid decline in imports from Europe. Prices, now in the range of 13 to 14 cents per lb, are expected to rise, if crude oil prices remain at current levels or rise.



Sources: U.S. International Trade Commission, C&EN estimates

The situation for *p*-xylene has both similarities to and differences from that of butadiene. It has but two major markets—in making either dimethyl terephthalate or purified terephthalic acid for polyesters and for export. The polyester use is dominated by one market—fibers—which is experiencing stiff competition from imported apparel containing polyester fibers. The rest of polyester consumption is mostly as films and bottles. Both of these end uses are growing, with polyester bottle resin production expected to increase more than 10% this year.

Exports of *p*-xylene probably exceeded 1 billion lb in 1986, out of total production of about 5 billion lb. New capacity has just come on stream in Japan, and more is expected during the second quarter, which will reduce exports in 1987 as much as 10%, if the plants operate well this year. However, growth in demand for polyester resins in the U.S. is expected to more than compensate for the decline in exports. Prices, now at about 17 cents per lb, probably will rise as much as other petrochemical prices during the rest of 1987.

eign plants, the U.S. capacity would be needed even less.

As the world's basic petrochemical industry becomes more widespread, trade increases between producers, in addition to the industry supplying nonproducing areas. If U.S. consumers find it costs less to import either basic petrochemicals or derivatives to meet their needs, then U.S. capacity might be shut down, as has occurred in the 1980s. The further rise anticipated in imports of crude oil, at somewhat higher prices, will reduce the competitive position of U.S. petrochemicals in world markets and will make capacity expansions less needed.

Petrochemical capacity continues to be built in foreign countries even though there is a slight overcapacity in the world. The latest major development, for example, is in South Korea, where Yukong Ltd. has contracted with M. W. Kellogg to build a steam cracker using Kellogg's Millisecond furnace technology with a capacity of 250,000 metric tons per year of ethylene. Derivatives of the ethylene and other petrochemicals made in the unit will reduce U.S. exports of the derivatives. The derivatives often are made into consumer goods and subsequently exported to the U.S. and other countries, which potentially reduces both U.S. consumption and exports and, in turn, the need to expand basic petrochemical production.

In the U.S., demand for petrochemicals will continue to grow but at rates of a quarter to half the rates a decade ago. New derivatives of petrochemicals and new uses will add to demand above that due to population growth. The growth in demand, although fractionally small, will be large in volume, so capacity expansions will be needed.

To be feasible, expansions would have to cost far less than the cost of building a new plant, a situation familiar to the ethylene industry. Capacity actually is expanded constantly at ethylene plants, the size of expansion varying with the operating situation. During scheduled maintenance shutdowns, extensive debottlenecking is done, often raising operable capacity as much as 10%. Because maintenance shutdowns are done as infrequently as three-year intervals, the average capacity gain fits the typical pattern now of about 3% annually.

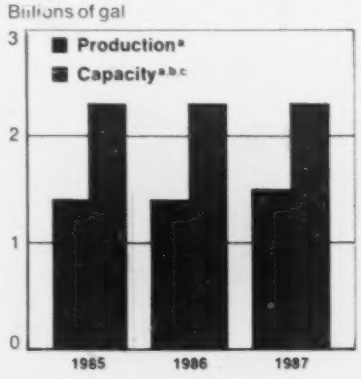
Until the early 1990s, capacity expansion needed in the basic petrochemicals, especially capacity expansion needed for ethylene, will be made this way.

For details of the near-term outlook for three of the largest basic petrochemicals, please see the following pages.

Benzene

- ***Output to rise slightly***
- ***Capacity on hold***
- ***Prices up and volatile***

PRODUCTION/CAPACITY



a All sources, nonfuel uses. b First quarter. c Limited by purification facilities available

MAJOR PRODUCERS

Chevron Chemical, Dow Chemical, Exxon Chemical, Shell Chemical, Standard Oil Chemical

HOW MADE

Catalytic reforming and thermal (steam) cracking of petroleum hydrocarbons; coking of coal; dealkylation of toluene

MAJOR DERIVATIVES

Ethylbenzene 55%, cumene 20%, cyclohexane 15%, nitrobenzene 5%

MAJOR END USES

Fabricated plastics and elastomers 55%, phenolic resins 20%, nylons 15%

FOREIGN TRADE

Exports less than 10 million gal; imports about 175 million gal

PRICE

Between $1.00 and $1.15 per gal

The outlook for benzene in 1987 is for somewhat better demand growth. Prices for this basic aromatic are volatile. On the large spot market centered around Houston, prices declined from $1.15 or more per gal as the year opened to about $1.05 per gal now.

As for other petrochemicals, the price of benzene directly reflects the cost of its main raw material—crude oil. Currently, to a lesser degree, benzene's price is affected by small changes in demand, for example, the current strong demand for its major derivative, styrene. However, some styrene plants are shut down for maintenance at this time, reducing benzene demand and prices and making styrene temporarily in short supply.

Benzene demand has changed little in recent years. Except for the recession year of 1982, benzene production in the U.S. has been in the range of 1.3 billion to 1.4 billion gal annually since 1980. This range is off about 15% from the peak production of 1.67 billion gal in 1979. In 1987, production may rise enough to bring the total to nearly 1.5 billion gal (11 billion lb).

Capacity to make and purify benzene also has declined to about 2.30 billion gal from the peak of 2.59 billion gal at the beginning of 1981. Capacity estimates vary because of assumptions that must be made about the feedstock for producing units and about their operating conditions. Some of the currently available capacity isn't operating because the source—a refinery catalytic reforming unit or an ethylene plant—has been shut down. Operation of other production facilities—such as those used to dealkylate or disproportionate toluene—is dependent on the spread between the values of toluene and benzene or on whether sufficient demand exists for the coproduct xylenes. These latter units can be started up relatively easily when costs suggest that a profit can be made by operating them. When shut down, the units often are fully depreciated and have little capital charges against them.

If benzene production in 1987 reaches 1.5 billion gal and the average operating capacity for extraction and purification this year totals 2.3 billion gal, then the average operating rate will be 65%. At this level of operation, and with prices volatile, only a minor return on investment would be made by producers, allowing little, if any, capacity expansion (even by debottlenecking).

Small growth in benzene output during the 1980s resulted partly from the lackluster performances by several large-volume derivatives, the most important being styrene. Styrene's raw material, ethylbenzene, accounts for more than 55% of U.S. benzene consumption. Another derivative, cyclohexane, is still well below its peak benzene consumption of 262 million gal set in 1979. Cumene, nitrobenzene (aniline), detergent alkylates, chlorinated benzenes, and other uses all fell below previous consumption levels during the last recession, and some are not yet back to previous demand levels. The consumption in making maleic anhydride fell to about zero from nearly 50 million gal as technology to oxidize *n*-butane took over.

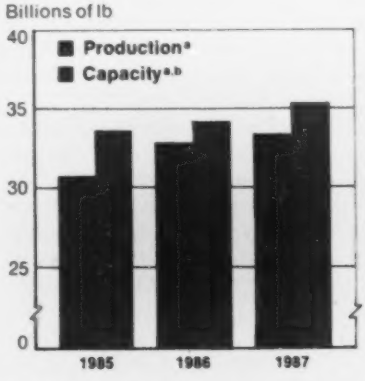
Benzene consumption in making chemicals is expected to rise in 1987 mainly because of increased production of styrene, cyclohexane, and cumene. Final consumption of much of these derivatives will depend on housing construction, which is expected to increase because of low interest rates. This year's increased demand for benzene in these areas will continue the pickup that began during the second half of 1986. It will continue through the first half of this year at least. For all of 1987, U.S. consumption in these uses will be up 3 to 4%. Benzene production, however, may have a smaller increase, of 1 to 2%, because imports could rise while exports of derivatives, such as ethylbenzene, may decline.

$CH_2=CH_2$

Ethylene

- *Production to grow*
- *Capacity up modestly*
- *Prices climbing*

PRODUCTION/CAPACITY



a All sources b First-quarter operating capacity; additional 2.5 billion to 4.0 billion lb shutdown possibly available depending on economics

MAJOR PRODUCERS

Amoco Chemicals, Exxon Chemical, Dow Chemical, Lyondell Petrochemical (Arco), Shell Chemical

HOW MADE

Thermal (steam) and catalytic cracking of hydrocarbons ranging from ethane to heavy gas oil

MAJOR DERIVATIVES

Polymers 50%, ethylene oxide 15%, ethylene dichloride 15%, ethylbenzene 10%, linear alcohols 5%

MAJOR END USES

Fabricated plastics 75%, antifreeze 10%, fibers 5%

FOREIGN TRADE

As monomer, exports about 325 million lb; imports 375 million lb

PRICE

14.5 to 15.5 cents per lb

Strong demand for ethylene in 1987 will require plants to be run at effective capacity. Despite the demand, capacity expansions for the year will be limited to debottlenecking efforts. Although producers can sell all of this olefin they can make, it is unlikely that prices will rise enough to cover additional plant capital costs.

Ethylene production in 1987 may reach a new high of 33.5 billion lb, but it's more likely to be a little short of that because of capacity limitations and maintenance shutdowns. Output growth for ethylene this year will not be so large as in 1986 when production rose an estimated 2.2 billion lb, or more than 7% over 1985 production, when, for the first time, the total rose above 30 billion lb. Production increases during 1987 likely will be held to the range of 500 million to 700 million lb, an increase of about 2%.

Because of modification to and restarting of a long-shutdown unit by Occidental Chemical and some debottlenecking by almost all producers during 1986, nameplate total of operating ethylene capacity has been revised from 34 billion lb upward to 35.1 billion lb. In 1987, the operating capacity is expected to expand about 2% because of the continuing debottlenecking programs by producers. Such increases in capacity will somewhat offset losses due to temporary shutdowns. The average operating rate for 1987 thus will be very close to the effective capacity.

Most ethylene sold under contract currently brings producers about 15 cents per lb. Price increases of crude oil and natural gas liquids could cause the ethylene price to rise later on. Unless the selling prices rise substantially, shut-down plants will not likely be restarted. The plants are down because they are less efficient in energy requirements and other operating costs than are plants now running. Moreover, considerable time and expense would be needed to start them.

The outcome will be varying degrees of tightness in ethylene supply throughout most of 1987. The ethylene inventory, believed to be less than 1 billion lb, was drawn down again in 1986 to meet demands and may be at a minimal level of less than two weeks' supply. Should mechanical problems develop in plants, ethylene supply could become very tight at times during this year and be reflected in volatile prices, especially in the small spot market.

Pricing and tightness of supply depend heavily on a few major derivatives of ethylene. In 1986, all of these derivatives showed production gains. Some, such as high-density polyethylene and polyvinyl chloride, grew at 6 or 7%, unusually well for large-volume products. Vinyl chloride production was up more than 8% in 1986 (C&EN, Jan. 5, page 10), reflecting increased exports as well as more polymerization. A few small uses of ethylene—synthetic ethanol, for example—fell in 1986.

Demand growth for ethylene derivatives has been forecast to be lower in 1987 than in 1986, because of anticipated slower growth in the economy. Low interest rates, however, again could spur sales of houses and autos as well as consumer nondurables, boosting demand growth for ethylene derivatives to nearly the 1986 rate. Meeting demands for derivatives has become as limited as for ethylene itself, governed by capacity availability. Exports of derivatives could decline and imports rise as a result of rising demand and prices.

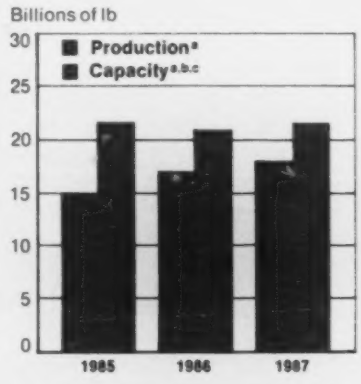
If demand for ethylene derivatives were to push up their prices, then ethylene producers might receive some added revenue. If that is the case, producers can shift operations to gain output. For example, they might start using more light hydrocarbons in plants designed to handle a wide range of hydrocarbons. Feedstock and operating costs would increase, but such increases could be recovered by higher selling prices spread over greater output. Then, ethylene production could rise more than is now forecast.

$CH_2=CH-CH_3$

Propylene

- ***Production growing***
- ***Capacity in excess***
- ***Prices firming***

PRODUCTION/CAPACITY



a All sources, nonfuel uses. b First quarter. c Limited by purification facilities available.

MAJOR PRODUCERS

Amoco Chemicals, Chevron Chemical, Exxon Chemical, Lyondell Petrochemical (Arco), Shell Chemical

HOW MADE

Thermal (steam) and catalytic cracking of hydrocarbons

MAJOR DERIVATIVES

Polymers 40%, acrylonitrile 15%, propylene oxide 10%, cumene 10%

MAJOR END USES

Fabricated plastics, resins, and elastomers 65%, fibers 15%

FOREIGN TRADE

Exports rising to more than 750 million lb; imports holding at about 350 million lb

PRICES

Chemical grade 9.5 cents per lb; polymer grade 10.5 cents per lb

This year propylene production for making chemicals and polymers will increase more slowly than during 1986. Strong demand for polypropylene, modest growth in other large propylene uses, and a fairly large rise in exports to Europe are behind the expected propylene output growth. Prices for both chemical and polymer grades of propylene will continue to fluctuate with the price of crude oil.

Propylene capacity, based on the size of purification facilities, easily can handle this year's demand growth. Capacity of these facilities to purify propylene to refinery grade (as low as 30%, but usually 50 to 75%), to chemical grade (90 to 95%), or to polymer grade (99% plus) exceeds 21.5 billion lb. Actual productive capacity for propylene could be greater than the 35 billion lb of ethylene capacity, if refinery and steam cracking sources are combined and the feedstocks used are such that high propylene yields will result. In addition to size of purification facilities, propylene for chemical and polymer uses is limited by the competition for it in fuel uses.

U.S. production of propylene for chemical and polymer uses will total about 18 billion lb this year, up about 6% from the 17 billion lb estimated for 1986. The 1987 gain will be half last year's gain, as derivative growth, especially polypropylene, meets capacity limitations. The 18 billion lb output will require the nominal 21.5 billion lb of capacity to be run at a rate of about 85%. That rate will not be high enough to stimulate very much expansion through debottlenecking.

The consumption pattern for propylene will change little except for a continuing increase in the share going to polypropylene and for rising exports to Europe. The surge in exports of propylene is expected to be short-lived, as European producers meet higher demands and prices by taking more from refinery production (which will increase as catalytic cracking increases in Europe).

A large share of propylene derivatives also is exported—equivalent to as much as 15% of U.S. propylene production this year.

Polypropylene leads the list of derivative exports. These exports, plus increasing U.S. demand, raised polypropylene production in 1986 to nearly 5.8 billion lb, up well over 12% from 1985. In 1986, polypropylene plants were operated at about 95% of nameplate capacity, which was their practical limit. A small amount of additional capacity for polypropylene will be coming on stream this year, but production will grow more slowly than last year as a result of capacity limitations. Consequently, demand for propylene used to make polymers—almost 40% of chemical and polymer uses—will grow more slowly in 1987. Nevertheless, demand for making polymers will grow faster than will demand for propylene in any of the other major derivatives.

Acrylonitrile, propylene oxide, cumene, various oxo chemicals, the oligomers, and isopropyl alcohol account for most of the remaining chemical consumption of propylene. None of these derivatives are forecast to grow very rapidly, because their end uses are not growing much.

With low growth expected in propylene demand in 1987 and with the apparent large capacity available, prices are expected to remain stable, rising only to reflect any higher crude oil prices. The effective halt in use of lead alkyls for increasing octane values in gasoline, however, will increase the value of propylene to refiners making alkylate. Chemical and polymer uses will have to pay the alternate value of propylene in gasoline components, plus purification costs, to obtain supplies from refinery production. This competition will increase prices slightly but will have little effect on chemical and polymer consumption, because these costs are relatively small and can be passed through to consumers of propylene derivatives.

Good Growth Forecast for U.K. Chemical Industry

Strong gains are expected in domestic demand, production, and exports over last year; prospects also are brighter for other European nations

Dermot A. O'Sullivan, C&EN London

The message from the U.K. Chemical Industries Association's recent annual Business Outlook conference in London is encouraging. "The industry's prospects for 1987 look bright," says Richard D. Freeman, chief economist for Imperial Chemical Industries. And, he adds, "we believe that 1988 will be another reasonably good year. It is an encouraging prospect that I hope can be achieved and extended in 1989."

Freeman was presenting conclusions reached by the CIA forecasting panel, which he chairs. Although these conclusions center largely on the state of the industry in the U.K., he and others at the conference broadened their vision to embrace Western Europe as a whole.

He and his associates expect U.K. domestic demand for chemicals this year to be more than 4% higher than last year. In this, they may appear to be going out on a limb somewhat considering that 1985 showed a mere 1% improvement, and last year brought a slight decline.

The panel is forecasting a substantial increase in the U.K.'s chemical export volumes, probably 6% ahead of 1986. That would be nearly double 1986's export growth over 1985. The anticipated 7% rise in the level of imports will be a fraction below 1986's import volume growth over 1985.

Movements in the exchange rate of the British pound against other currencies is a critical factor in these export and import projections, Freeman acknowledges. "In this respect, the most important are the West German deutsche mark and the dollar," he notes.

For instance, the pound sterling has been losing ground against the mark during the past 18 months or so. Compared with an exchange rate of more than four to the pound in mid-1985 (which was down from about five marks early in 1981), it now stands at less than three. "For purposes of the forecasts, we have assumed a deutsche mark-to-sterling average of 2.85 for this year. This represents an average depreciation of sterling against the deutsche mark of 10.5% compared with 1986," Freeman remarks.

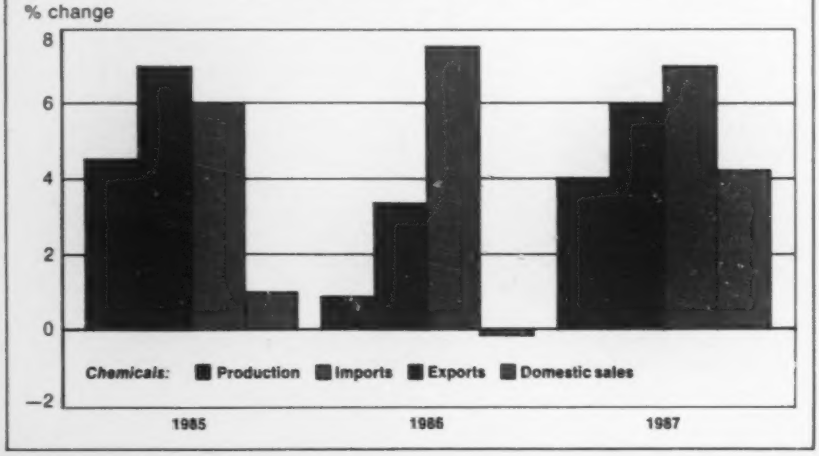
As for the dollar, he expects the 1986 average of about $1.45 to the pound to remain essentially the same this year. It may not turn out to be the case, however. The dollar continued to weaken in January. By the end of the month it had moved to around $1.55 to the pound.

"Taking the sterling index [its weighted average value against a basket of currencies], the forecasting panel is assuming an overall fall of around 6% this year. We have, therefore, built a considerable improvement in competitiveness from

C&EN staff photos

Freeman: much higher profitability

U.K. domestic sales of chemicals will show sharp rise



the exchange rate into the forecasts," he points out. "Moreover, the U.K. will hold the advantage in terms of unit labor costs measured in a common currency," he adds.

The cost of oil, both as an energy source and as feedstock for petrochemicals, will influence the outcome of chemical companies' business results, as it has in the past. Ironically, selling prices of chemicals came under pressure in 1986 reflecting the decline in the oil price. This year, prices are expected to stop falling in Europe, or even rise a little, as demand strengthens, and because of an assumed rise in oil prices to about $18 a barrel. "Profitability in the [chemical] industry should show a considerable improvement this year compared with 1985 and 1986," Freeman predicts.

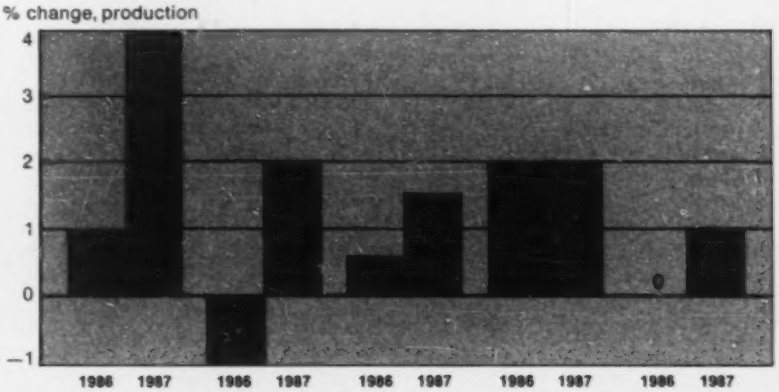
Overall, chemical production in the U.K. this year likely will exceed 1986's by 4%. That's twice the increase foreseen for West Germany and Italy, and compares with a 1.5% advance in France and 1% in the Netherlands.

U.K. output of most chemical products is likely to be stepped up. The biggest gains are expected to be recorded by inorganic and organic chemicals, man-made fibers, and paints. On the other hand, production of cosmetics and pharmaceuticals may remain about on a par with 1986. Declines are likely in detergents, dyes, and plastics. Fertilizers will remain depressed.

"If chemical production generally increases in line with our forecasts, productivity will rise at a faster rate than it has for several years, and to a considerably greater extent in the U.K. than in its main competitor countries," Freeman notes. "We expect a further slight fall of some 1% in employment in the U.K. industry to bring the total to about 323,000."

Looking at the global macroeconomic picture, which, of course, affects the chemical industry, Alan Budd, director of economic forecasting at the London Business School, believes "that 1987 and 1988 will be years of comfortable growth and low inflation." He adds, "I am convinced that the potential benefits of the fall in oil prices have simply been postponed."

U.K. to lead chemicals growth in Europe



Among the 24 leading industrial countries that comprise the Organization of Economic Cooperation & Development (OECD), consumer spending was strong last year, but businesses were reluctant to expand output, Budd recalls. "Consumer demand, therefore, was met out of inventories, or by increased imports from outside OECD, particularly from countries like Taiwan and South Korea, which gained a considerable competitive advantage through exchange rate changes.

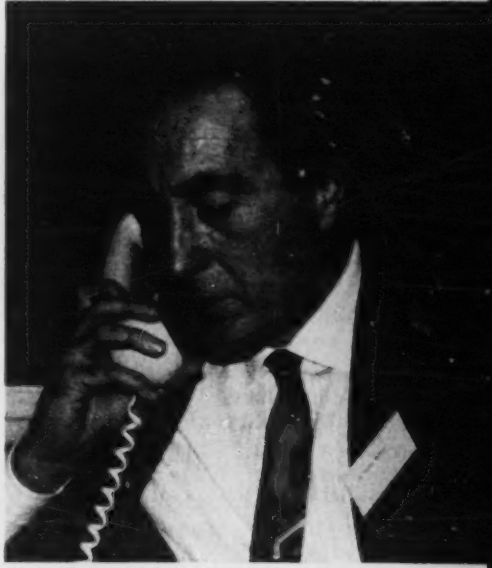
"The delay in seeing a strong recovery is hardly surprising," he adds, "when we realize that the world economy was subject to two major shocks in 1986—the sharp fall in oil prices and the dramatic fall in the dollar. Shocks are always upsetting, even if their long-term effects may be favorable. The best we can say is that 1986 ended rather more strongly than when it started."

Contrary to the position taken by Freeman and his colleagues, Budd holds that the price of oil will fall back to $15 a bbl, and then rise slowly in later years. Although admitting the outcome is highly uncertain, he doesn't expect that the Organization of Petroleum Exporting Countries (OPEC) will be able to sustain it at $18 a bbl.

He foresees little change in fiscal and monetary policy in the key countries this year, which in turn would influence currency exchange rates. "Neither the European economies nor Japan will embark on expansionary policies, and there will only be slow moves to deflationary policies in the U.S.," he thinks. "I also assume that threats of protectionism will not develop into a trade war."

Based on these and other assumptions, Budd expects that gross national product for OECD member countries on average will rise 4% this year over last compared with the 2.3% gain in 1986. Industrial production might advance a healthy 5%, whereas the increase in consumer prices, a measure of inflation, could fall back to 2%.

The encouraging outlook for the European chemical industry reflects to a degree improvement in the quality of its management, believes



Wamsley: management has improved

European capacity use rises as number of producers falls

	Capacity utilization, %	
	1986	1991
Ethylene	84%	71%
Polyethylene, low density and linear low density	89	82
Polyethylene, high density	84	64
Polypropylene	98	75
Polyvinyl chloride	82	64
Polystyrene	83	60

	Number of producers	
	1986	1990
Polyethylene, low density	15	21
Polyethylene, high density	14	20
Polypropylene	14	18
Polyvinyl chloride	16	24
Polystyrene	20	28

Source: Greenwell Montagu Securities

Stuart H. Wamsley, director in charge of international chemical research at Greenwell Montagu Securities, a London brokerage firm, who has been a vocal critic of the industry over the years. "The present generation of leadership is far more prepared to learn from the lessons of the past," he says.

"It is apparent that the more influential of today's chemical industry leaders not only recognize the opportunities and problems, but are seizing those opportunities to develop strategies for the future. Now there is much more awareness that only those companies that can maximize their talents, and develop and exploit the best market-led technology will emerge with strength. This, allied with the current phase of reshaping, divesting, and restructuring, could well ensure a far better future than seemed likely even just a year or two ago.

"Even in an era of slow growth, which I believe will continue for quite some time yet, the European chemical industry is alive and thriving. The prospects of survival, even of growth, are looking better now than for many a year," he believes.

The process of rationalization of the European chemical industry has made great strides. Since 1980, ethylene capacity has been cut back 25% to its present level of some 30 billion lb. The same has happened with low-density polyethylene (down 24% to 11.2 billion lb), high-density polyethylene (down 17% to 5.1 billion lb), polyvinyl chloride (down 12% to 1.6 billion lb), and polystyrene (down 7% to 4.9 billion lb). Meanwhile, the remaining plants are operating at higher levels of their design capacity.

"My view is that a further reduction in the number of producers now is a greater priority than the straight elimination of capacity," Wamsley says. "Hopefully this can take place in part by continuing withdrawal of the weak players as well as by farsighted measures such as the ICI/EniChem joint venture in PVC. While it is too early yet to total the disappearances in terms of tonnage, the end result is bound to be several really significant steps in the right direction.

"One point, though—fewer producers does not necessarily mean less capacity. Perhaps the best illustration of this is in PVC; there now are only 16 producers against 24 a few years ago. That's a drop of 33%, but only 12% of Europe's capacity has been shut down.

"Perhaps surprisingly, there now is increasing evidence to suggest that even in this disastrous product area, supply/demand balance is close. What I find increasingly encouraging is that there appears to be a continually widening list of product areas that are getting close to this supply/demand balance."

An obvious way of reducing the number of companies in a particular product area is by mergers and acquisitions. "We are not seeing too much of that in Europe these days," Wamsley observes. That is not to say that the Europeans are turning their backs on this form of restructuring. It's just that they have all decided that most important acquisitions have to be made in the U.S. They are cash-rich, and the decline of the dollar has made American assets look particularly cheap.

"With U.S. companies embroiled in their own attempts at restructuring, there has been no shortage of takeover candidates. Four [European] companies alone—BASF, Hoechst, ICI, and Rhône-Poulenc—not counting another 20 or so that also have been active, have spent well [over] $6 billion in the past two years in acquiring some famous American chemical names.

"Europe has bitten off some very big mouthfuls. I just hope the digestive system is in good working order. For while a number of these takeovers have good prospects, one or two of the latest ones smack of management being rushed into the game through fear of being left out. It will be interesting to assess results in a few years' time."

Wamsley foresees as "very probable" that Western Europe's share of base petrochemicals' production will decline in coming years in relation to other parts of the world. He notes that in 1980 Western Europe accounted for 34% of global petrochemical sales that totaled $691 billion. Next in line was the U.S. with 23% of the total, followed by Eastern Europe with 19%, and Japan with 11%. Several countries made up the 13% balance. Looking ahead to 1995, he predicts a shift, with relative declines for Western Europe (to 25%), the U.S. (to 20%), and Eastern Europe (to 18%), while gains will be made by Japan (to 14%) and the "rest of the world" (to 23%).

"The threat of the new producers should not be underestimated," he warns. "In a number of product areas the quantities equate to, or exceed, the whole of the existing capacities of Western Europe. The conclusion I have to draw is that, given a shrinking share of production, Western Europe cannot justify having 12 of the world's top 20 companies, even if these companies diversify basic chemicals production drastically.

"The new sources of competition promise another unwelcome period of adjustment for European (and American) chemical producers. Having gone through two stages of painful restructuring and realignment in response to the pressures of the 1980s, this new challenge poses formidable problems, and the consequences will be substantial. Fewer European companies will be making their living from production of commodities." □